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AKF

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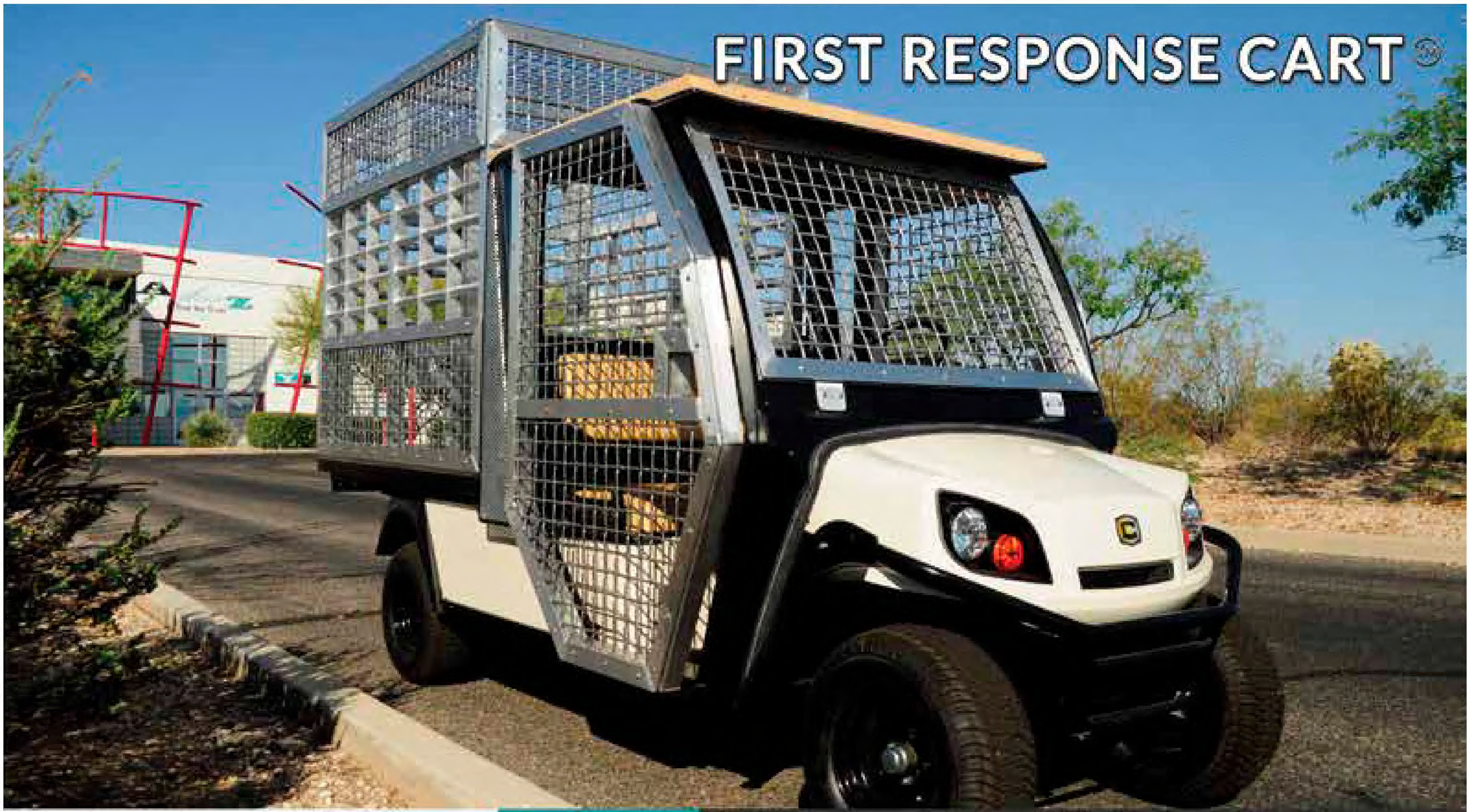

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ABOUT THE COVER

Ivan, born to Moka (dam) and Mrithi (sire), is one very special western lowland gorilla. After his mother developed mastitis, Ivan was partially hand-reared by the primate keepers and docents from six-weeks-old to four-months-old. He received around the clock care and "family visits" with the troop to ensure a safe reintroduction at four months of age. Keepers worked with him to strengthen his muscles, carry him, groom him, and communicate with him just as Moka would have. Ivan was successfully reintroduced at four months.

Ivan recently turned eight-years-old and enjoys wrestling with his three-year-old brother Frankie. Entering into adolescence, Ivan has begun to take cues from his father, sometimes leading the troop of six outside in the mornings for breakfast.

Western lowland gorillas *(Gorilla gorilla gorilla)* are a critically endangered species, with 100,000 individuals remaining in their native range of Cameroon, the Democratic Republic of the Congo, the Central African Republic, Gabon, Equatorial Guinea, and the Republic of Congo. *Photo submitted by Amanda Westerlund of the Pittsburgh Zoo and PPG Aquarium.*

Articles sent to *Animal Keepers' Forum* will be reviewed by the editorial staff for publication. Articles of a research or technical nature will be submitted to one or more of the zoo professionals who serve as referees for *AKF*. No commitment is made to the author, but an effort will be made to publish articles as soon as possible. Lengthy articles may be separated into monthly installments at the discretion of the Editor. The Editor reserves the right to edit material without consultation unless approval is requested in writing by the author. Materials submitted will not be returned unless accompanied by a stamped, self-addressed, appropriately-sized envelope. Telephone, fax or e-mail contributions of late-breaking news or last-minute insertions are accepted as space allows. Phone (330) 483-1104; FAX (330) 483-1444; e-mail is shane.good@aazk.org. If you have questions about submission guidelines, please contact the Editor. Submission guidelines are also found at: aazk.org/akf-submission-guidelines/.

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FROM THE PRESIDENT

National Zoo Keeper Week always recognizes the exemplary work of keepers, but the 2021 theme truly brings into the spotlight something that animal professionals have known for years: Zookeeping takes improvisation, adaptability, and persistence.

Over the past year, the requirements on keepers have been stretched to their limits. In the face of a global pandemic, keepers have had to respond to constant changes and challenges. Facilities have closed and some have re-opened. State and local health guidelines have constantly evolved. And the care for the animals we work with has had to be altered. National Zoo Keeper Week always recognizes the exemplary work of keepers, but the 2021 theme truly brings into the spotlight something that animal professionals have known for years: Zookeeping takes improvisation, adaptability, and persistence. Let's take a look at what those words truly mean to keepers.

Improvise. Whether it's responding to interesting keeper chat questions or building a new enrichment item out of some spare parts from old items, improvisation is familiar to all keepers. Quickly figuring out how to work a three-person run alone for two weeks because your teammates have to quarantine is a new form of improvisation. But keepers developed the skills and are ready to put them to use in any situation.

Adapt. Zookeeping is a field of constant change with animal diets, exhibits, and numbers in an ongoing state of evolution. Those skills were put to good use when public health guidelines constantly evolved and necessitated new pathway configurations, mask rules, and social distancing requirements.

Persist. Animals aren't the only thing we keep as we also keep at it when training new behaviors or working to resolve issues with teammates. Maintaining consistent resolve in the face of coming in to work every day when teaching opportunities and interactions with coworkers are on hold takes a special type of persistence.

National Zoo Keeper Week 2021 promises to be one of the most exciting in its history as keepers and facilities around the country begin to see a return to normalcy. But don't forget to recognize all of the hard work and resolution from keepers during a difficult time. Be sure to continue your amazing work and live up to the NZKW 2021 them of **Improve, Adapt, Persist: Keep on Keepin' On.**

Cheers,

Paul

Paul

AAZK Chapters 2021

A Continuing Force in Global Conservation

Ed Hansen
AAZK CEO/CFO

The following information was compiled from the AAZK Chapter Re-charter materials submitted in 2021 and details the conservation spending by AAZK Chapters in 2020.

On March 15, 2021 AAZK had **117 duly chartered Chapters** within the Association, with Chapter membership totaling **1727** with another **550** non-AAZK members who participate in Chapter fundraising activities. **Eighty-Eight** of those AAZK Chapters made contributions to fellow non-profit conservation organizations or registered charities during a global pandemic.

In 2020, AAZK Chapters contributed **$492,839.31** to deserving groups and charities around the globe. The average donation to conservation charities totaled **$5,600.45** per AAZK Chapter. AAZK Chapters made **387** individual donations to an amazing number of non-profit or charity organizations around the world, including donations directly to **14** of our **31 AAZK Conservation Partners**.

The primary beneficiary of the generous contributions to conservation from AAZK Chapters are our internal conservation projects, **Bowling for Rhinos** and **Trees for You and Me**. AAZK Chapters raised and donated **$228,268.99** for species and habitat conservation in the US, Asia and Africa and funded two grants in conservation, the BFR Conservation Resource Grant **($4,349.37)** and the Trees for You and Me Restoration Grant **($5,800.67)** during the pandemic.

After supporting AAZK Conservation programs, AAZK Chapters donated **$176,772.54** to over **200** worldwide conservation projects, emergency relief, or other charitable ventures, with the highest number of Chapter donations supporting the wildfire relief efforts in Australia. Also included are **28 AAZK Chapters** who donated **$43,229.56** directly *back* to their **Host Facilities** to support purchase of enrichment items, enclosure renovation projects, scholarships or research within their own facility.

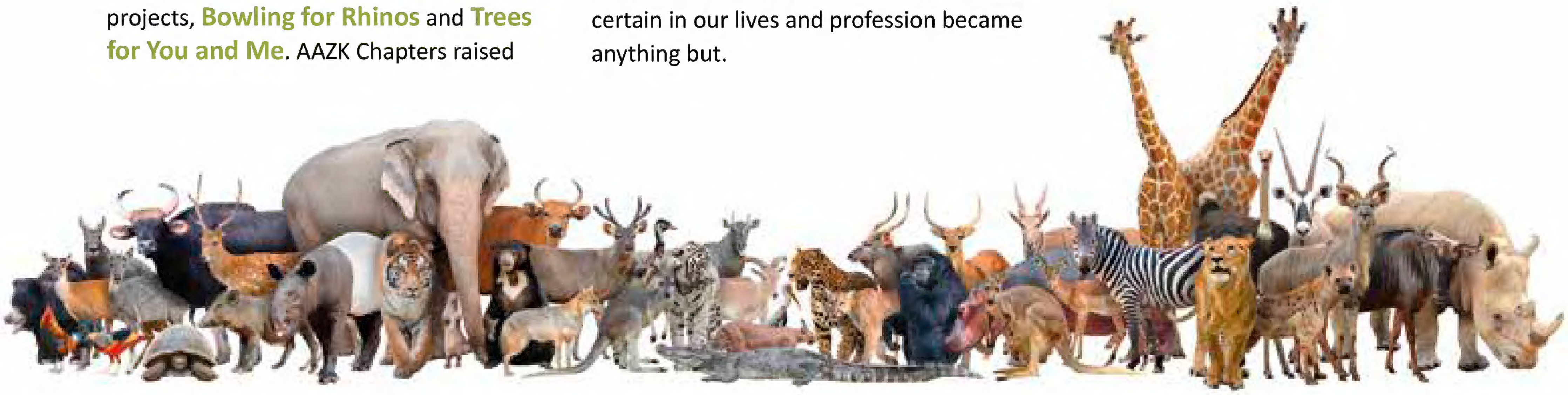
The direct return to a host facility, combined with the group effort of global conservation fund raising directly addresses and answers the question from a facility director who asks: Why should I join AAZK as an Institutional Member and what is the benefit to me? Think about it – that's almost a half million conservation dollars in a year where almost everything certain in our lives and profession became anything but.

The Mission of AAZK and our Chapters is straightforward:

The American Association of Zoo Keepers exists to advance excellence in the animal keeping profession, foster effective communication beneficial to animal care, support deserving conservation projects, and promote the preservation of our natural resources and animal life.

AAZK endeavors to make animal keepers better animal keepers, to provide docents and volunteers with factual information on species housed in their facility and to prepare students for the realities of our profession.

Thank you once again to all of the AAZK Chapters, members and staff who worked tirelessly in what will hopefully be in the rear view mirror as one of the most trying years of their lives, day in and day out, while fellow keepers were furloughed, laid off or terminated; to reinforce the Mission and Vision of AAZK and who continue to be a force in global conservation.



Using Video Recording to Better Understand Space-Use in Zoo Monkeys

Alicia Foley
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Austin, Texas

ABSTRACT

While species exhibit similar generalized behaviors, not all individuals share the same preferences or exhibit all of the same behaviors. Using recorded videos of each enclosure, I evaluated how two groups of monkeys, a group of ten Guianan squirrel monkeys (*Saimiri sciureus*) and a group of three female tufted capuchins (*Cebus apella*), used the space within their respective enclosures. Using a GoPro recording device, the animals were observed in their enclosures and their use of different parts of their enclosures were documented and calculated. Squirrel monkeys were observed on the ground and in the lower section of their enclosure most of the time while the capuchins were observed in the middle level of their enclosure as well as on the ground. The results did not support my hypothesis, which was based on in-person observations of the studied primates. This study suggests that animals behave differently when people are present and provides implications for the use of recording devices as tools for regular observation of captive animals.

Keywords: capuchin, squirrel monkey, enclosure, space use, behavior, captive management, welfare, GoPro, video recording

INTRODUCTION

The indicators for animal welfare in captive environments have changed over the last several decades. There has been a lot of research done on the impact of the environment on a captive animal's behavior and well-being. However, an animal's captive environment was not always considered crucial to their welfare (Nolen, 2002). Longevity used to be the primary indicator of good animal welfare; decades later, offering naturalistic exhibits meant that a facility promoted high animal welfare (Caring for Wildlife, 2016; Nolen, 2002). Standards of animal care and management are always evolving. Now, these standards acknowledge the different indicators of animal welfare, which include behavior and environment (Caring for Wildlife, 2016). Currently, animal welfare for captive animals includes habitats that allow for the residing animals to make choices regarding their environment, their movement, rest, and food opportunities (Caring for Wildlife, 2016; Wilcox, 2012). Observing these behaviors and choices is a key step in providing species- and individual-specific care (Freeman, Schulte, & Brown, 2009; Khadpekar, Whiteman, Durrant, Owen, & Prakash, 2018).

While daily observations are typically part of an animal caregiver's daily routine, some keepers find this challenging. Low staffing, limited time, numerous enclosures, the distance between enclosures, and more can prevent a caregiver from spending adequate time observing each animal they care for. Additionally, many animals behave differently when people are present versus when they are not (Learmonth, Sherwen, & Hemsworth, 2018). A caregiver can only observe what they see when they are in view of a certain animal or a group of animals. This is where video recording can be useful. Recorders can assist when in-person observations are not possible, such as overnight, during busy parts of the day, or when in-person observations might be distracting or disturbing, such as during breeding periods or birthing moments.

I have worked with primates in a variety of facilities. I have worked at an AZA-

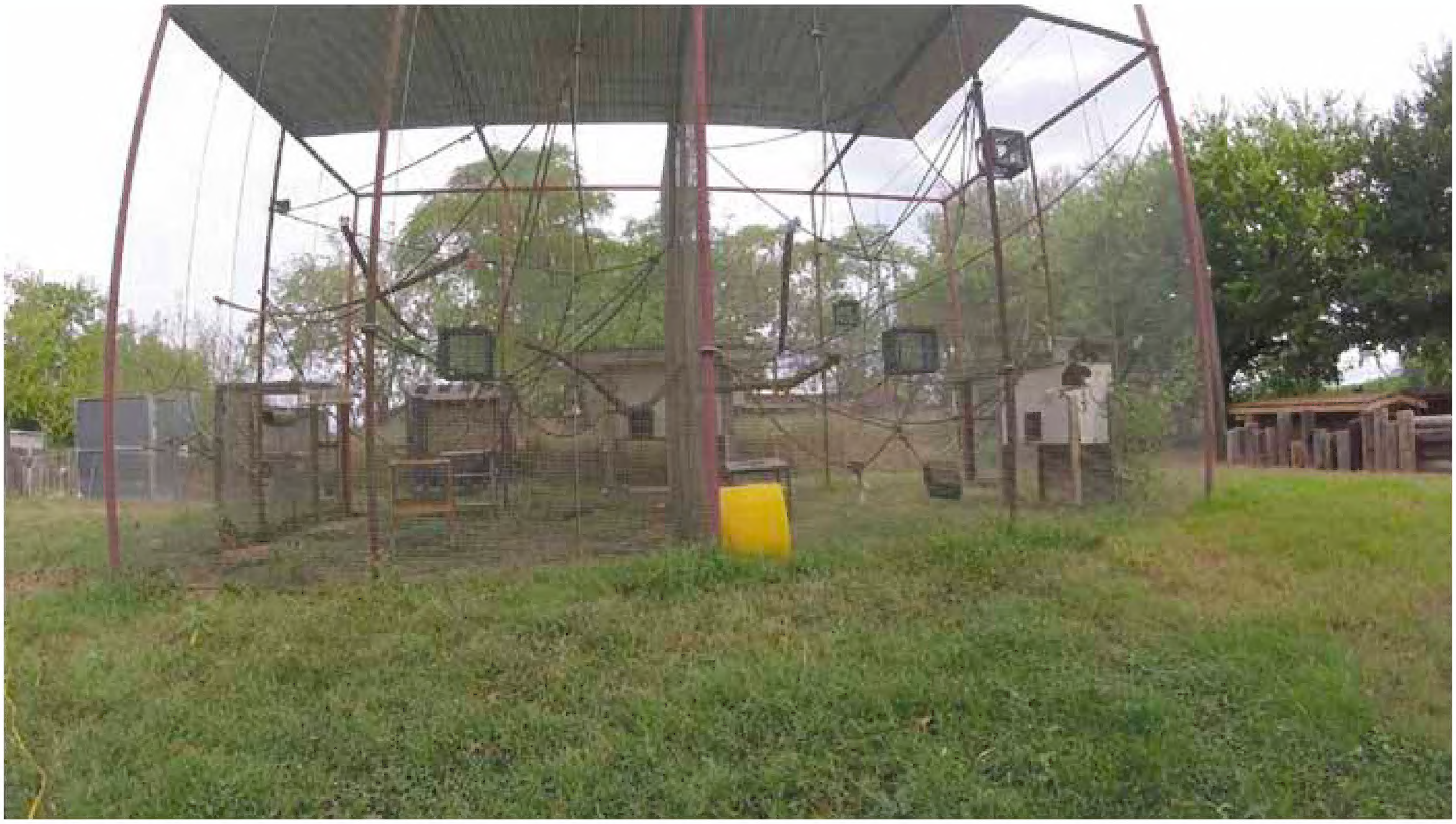

Figure 1

accredited zoo, a private sanctuary, a biomedical testing facility, and a privately-owned zoo. Daily, routine, medical, and behavioral observations were important in each facility. The enclosures were all different sizes, shapes, and filled with different furniture and perching. Coleman (2012) emphasized the value of evaluating and considering the individual needs and preferences of primates that are cared for by humans and that resonated with me. I read another study, co-written by a behavioral researcher I had known when I worked at the biomedical testing facility, that studied space-use of captive gorillas and chimpanzees (Ross, Calcutt, Schapiro, & Hau, 2010). I wanted to apply the same type of research to my daily work. If I could learn more about the habits or preferences of the primates under my care, then I could create more effective enrichment and enclosures, as well as improve their general care. I chose two species that I had seen utilize many areas of their enclosures: common squirrel monkeys (*Saimiri sciureus)* and tufted capuchins (*Cebus apella)*. Their high activity levels and their interest in people and novel items made them a great choice for this behavioral study. For this study, I wanted to explore how each group of animals used the space inside their respective enclosures.

Tufted, or brown, capuchins are often described as intelligent animals, even compared to other highly cognitive primates, and they require copious amounts of stimulation and enrichment under human care (Boinski, Swing, Gross, & Davis, 1999). This species also exhibits a high level of object-manipulation, both in the wild and in captivity. Both capuchins and squirrel monkeys have been trained to perform certain tasks using positive reinforcement training. They have successfully been trained to accept injections and to sit on a scale for weight checks (Gillis, Janes, & Kaufman, 2012). Field studies have shown that tufted capuchins and common squirrel monkeys coexist together in the wild forests of Guyana (Levi, Silvius, Oliveira, Cummings, & Fragoso, 2013). There are various hypotheses about why they mingle in the wild, but one thing is certain: both species are more commonly seen in the same places more than other primates in the same areas.

How do two species of monkeys use enclosures that are similar in size and structure? Based on my casual observations while working with these animals, I predicted that the capuchins would spend more time on the ground than the squirrel monkeys would. I had seen the capuchins on the ground in passing but I had never noticed the squirrel monkeys on the ground or in the lower portion of their enclosure.

METHODS

The groups of monkeys that I chose to observe reside in a single structure that is separated into two enclosures by a shared mesh wall (Figure 1). Each half of the structure is 4.572 meters wide, 4.572 meters deep, and 4.572 meters high. The monkeys each have a night house outside of the main enclosure, with a mesh tunnel leading inside. The floor of the main enclosure is dirt and grass. There are ten Guianan (or common) squirrel monkeys with three males, four females, and three unidentified sexes. The ages are mostly unknown, however, the youngest were born mid-2019 and were under a year old at the time of this study. As for the capuchins, there were three geriatric females.

I found that my study was limited by the amount of spare time I had during the workday to stop and observe each group. To get adequate amounts of data, I would need assistance and so I turned to recording. I soon realized, too, that recording the monkeys instead of observing in person provided better data because my presence was not a variable or a stimulus. Being able to rewind and review made for more accurate data collection, as well.

I set up a GoPro video recorder on a tripod in front of the enclosures, positioned so that both exhibits were clear and recorded simultaneously. I did not record night house usage because I didn't have a way to record that and the main enclosure simultaneously. I chose five random days within 31 days with recording times varying between the hours of 0800 and 1500. I collected a total of eight hours, twenty-four minutes, and five seconds of footage. I did not record during inclement weather, such as high winds or precipitation due to a lack of equipment weatherproofing.

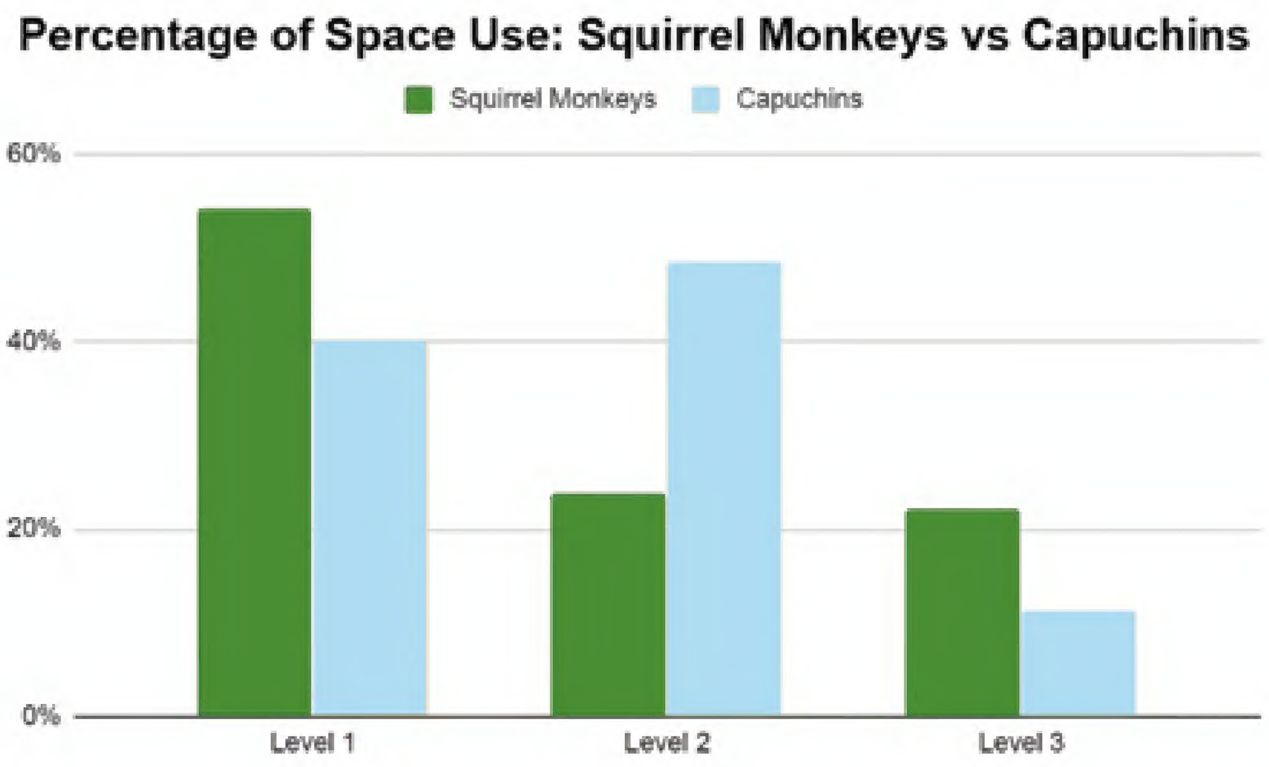

Figure 2. Bar graph showing the comparative space-use of each species. Level 1 is the bottom third of the enclosure and Level 3 is the top third.

RESULTS

Figure 2 above shows the differences in space use between the species. Squirrel monkeys spent 54% of their time in the lowest third of their enclosure while capuchins spent 40% of their time in the same area. Capuchins spent nearly 50% of their time in the middle level of their enclosure while squirrel monkeys only spent 24% of their time in the middle. As for the highest level, level three, capuchins spent only half as much time there as the squirrel monkeys did, at 11% and 22% respectively.

Figures 3 and 4 show where each species spent most of the observed time in their respective enclosures. The squirrel monkeys spent most of the time on the lowest level and split the rest of their time between the middle and top areas of their enclosure. The capuchins spent most of their time in the middle level of their enclosure and a good amount of time at the bottom level. They spent very little time at the very top of their enclosure.

DISCUSSION

My hypothesis, after some initial observations of the studied individuals, was that capuchins will spend more time on the ground and in the lower portion of their enclosure than will the squirrel monkeys located next to them. Even while watching the footage and collecting the data it was easy to see that my hypothesis would not be supported. My hypothesis was based on what I had seen in-person when observing both groups of monkeys. When I was near or inside the enclosure, the squirrel monkeys were never on the ground, whereas sometimes the capuchins would be on the ground when I was walking or driving past. The video recordings showed that any time a keeper or guests were in or near the enclosure (guests did not go inside), both groups of monkeys left the lower portion of the enclosures and were either in the middle or top section - or inside their night house.

What I didn't think of when planning my study was how the monkeys might behave differently in my presence compared to when no one was around. Not only are there times when keepers can't sit and observe every animal under their care (overnight, when the keeper is observing another enclosure, when the keeper is tending to other tasks, etc.), but the animals can behave differently in the presence of the keeper - or in the presence of guests, or maintenance workers, or horticulturists. Video recording can give animal care staff, veterinarians, and behaviorists a more complete picture of the behaviors and actions of an animal or a group of animals than casual or daily observations might.

People are present near or in these enclosures a very small fraction of the day so what the monkeys do outside of the presence of people is most likely what they do most, both behaviorally and in regards to the space they use in their enclosures. While the amount of time that the groups spent in the lowest portion of their enclosures was statistically significantly different than time spent in other sections, there was a less than 15% difference in the amount of time between the species - but the capuchins were not on the higher side of those numbers. The squirrel monkeys were on the ground more. In the wild, squirrel monkeys forage for small fruits in the lower and middle canopies of the forests they reside in (Cawthon Lang, 2006). There was a greater difference between the time spent in the middle section of the enclosures, with capuchins spending nearly 25% more time in the middle than the squirrel monkeys. While observing the groups in person I had seen the capuchins on the ground more often than anything, so I had assumed that they spent most of their time there. Whenever I was near the squirrel monkeys, they were in the middle and upper sections of their enclosure. In the wild, capuchins also spend time in the understory and the middle and lower canopies (Gron, 2009). What I learned from the

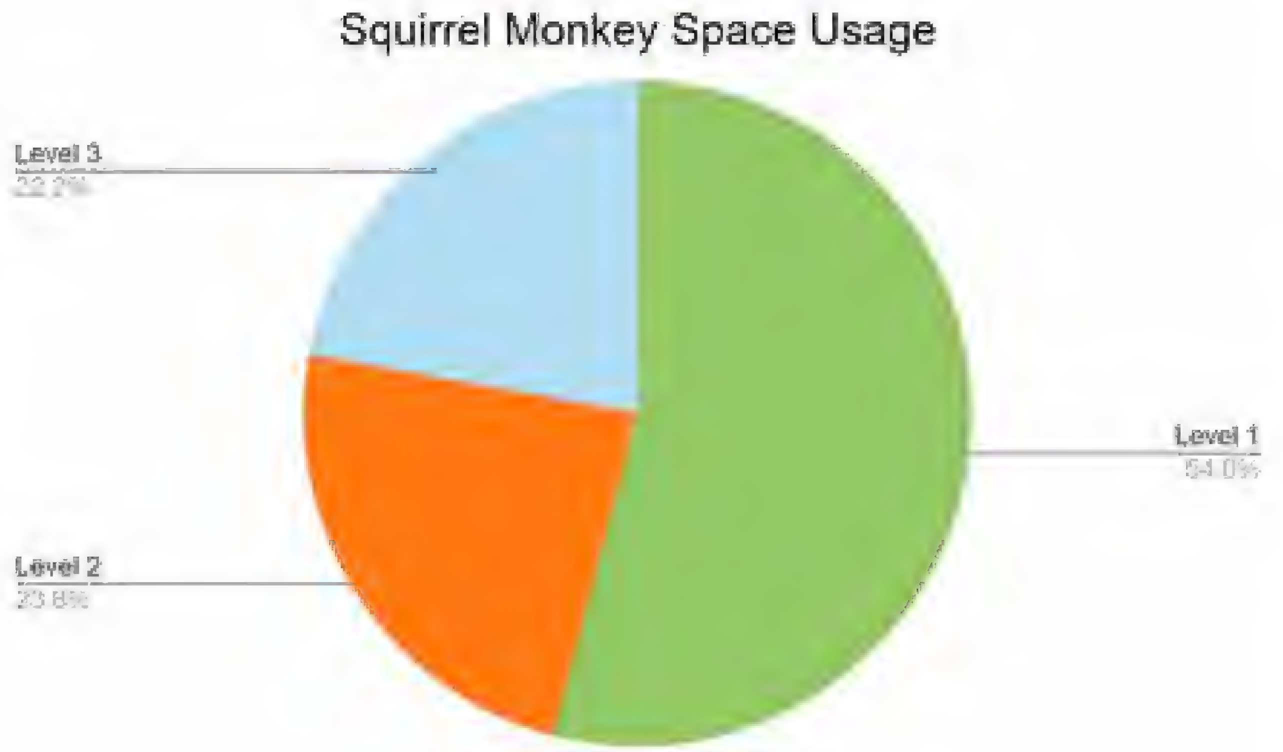

Figure 3. The pie chart gives insight into the amount of time squirrel monkeys spent in each section of their enclosure, in percentages.

recordings was that these groups of animals use different areas of their enclosures when keepers are around than when keepers (or other people) are nearby.

The implications of this study are numerous. First, we know that the behaviors displayed in our presence aren't necessarily the most common behaviors of any given species or individuals. Depending on the workload of a caregiver, they might spend more time performing tasks that are not within sight of their animals, such as maintenance and diet prep or cleaning dishes and keeper areas. Whenever people were present in the video footage, whether they were inside the enclosures or outside (keepers, private tours, grounds keepers), both groups of animals moved to elevated spots off the ground and, in the case of the capuchins, above the humans. Animals often behave differently around specific people, as well, whether it's guests, specific keepers, maintenance staff, among others. The use of visual recording devices helps animal caregivers gain a more complete picture of what the animals do all day, whether people are around or not. Cameras have shown significant differences in space-use for captive animals when humans are present versus when they are absent, with some animals avoiding space visible to people (Powell & Vitale, 2016; Learmonth et al., 2018; Rose, Lloyd, Brereton, & Croft, 2018). A study at the Melbourne Zoo, using several cameras, suggested that in an enclosure that was open to visitors, a group of Quokka (*Setonix brachyurus*) avoided areas where they could be seen from the walkway when the enclosure was open to visitors (Learmonth et al., 2018). The quokka were seen more often in those same areas when the enclosure was closed to the public. Using video recordings, the animal staff at the Bronx Zoo were able to determine the individual preferences of their female Asian elephants regarding indoor and outdoor space-use overnight (Powell & Vitale, 2016).

Another implication is that individual behaviors and preferences should be considered when designing enclosures, as Coleman (2012) found in her study as well. This group of squirrel monkeys (there are two others on the other side of the grounds) is more sociable with people. The capuchins, on the other hand, always climb higher in their enclosure when people and keepers are around/inside. They use threatening faces and gestures. Feeding the squirrel monkeys in the lower area of their enclosure will not prevent them from eating even if people are inside or around. Feeding the capuchins in the lower area, however, might create moments where the capuchins won't access their food when humans are around.

CONCLUSION

This study gave insight into how animals might behave differently in the presence of people and how technology can give a better insight into captive animal behavior and space-usage, without the constraints of time or keeper influence on behaviors.

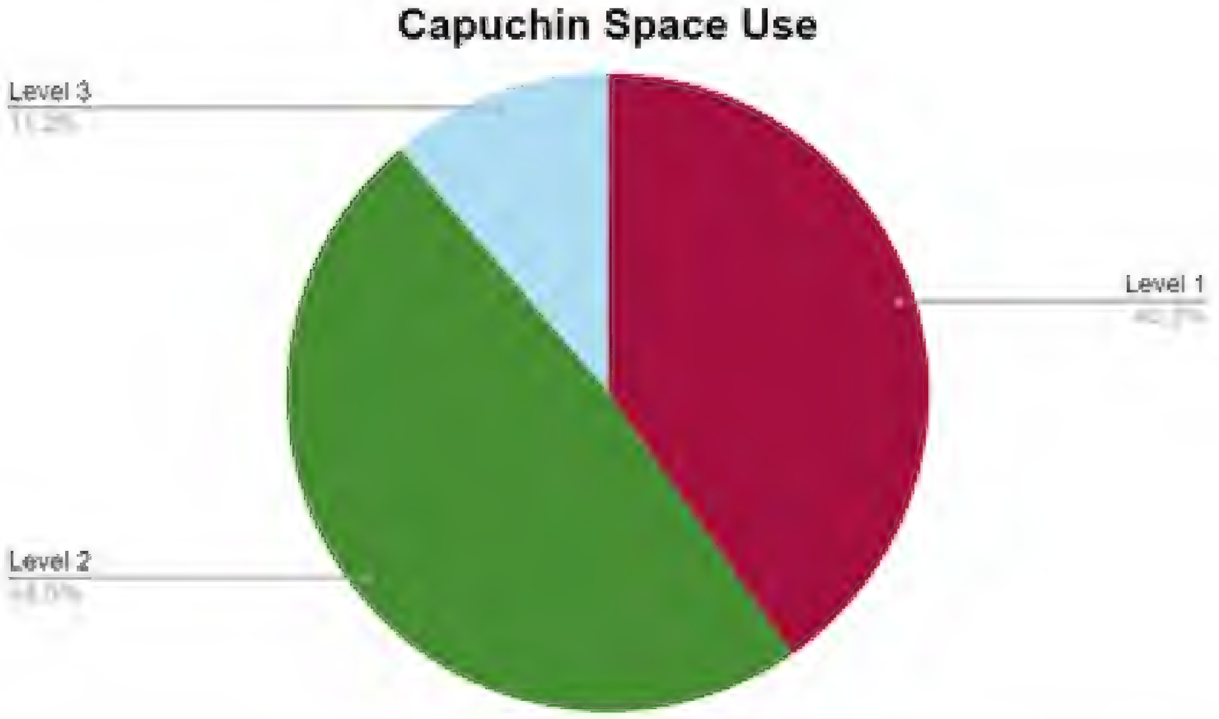

Figure 4. The pie chart gives insight into the amount of time capuchins spent in each section of their enclosure, in percentages.

To understand the behaviors of captive nonhuman primates, many observations need to be made and documented. Animal caregivers only see a small part of the daily activities of captive animals and there is so much to see and learn that can impact the welfare of these animals. Video recorders could cover the gaps created by lack of staffing and lack of time, as well as give insight into the behaviors that occur when keepers or unfamiliar people are not around.

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Spatial Use and Activity Budgets of Bornean Orangutans (*Pongo pygmaeus*) within a Zoological Setting

Bret Pilney Jr., Primate Keeper I
Zoo Atlanta
Atlanta, Georgia

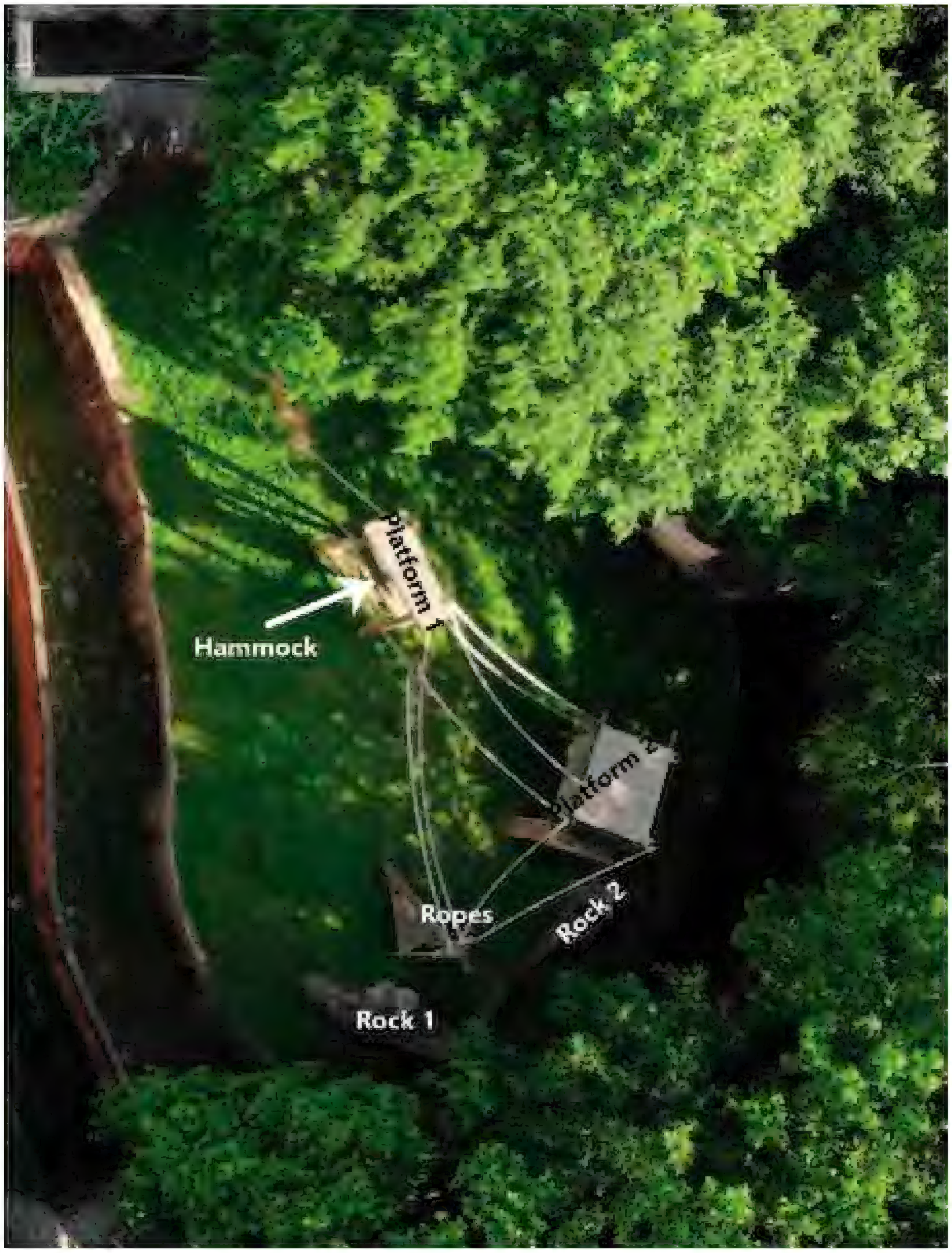

Figure 1

INTRODUCTION

In order to provide the best animal welfare possible, it is necessary to understand how much of an animal's environment is being utilized (Ross et al., 2011). This is especially important for nonhuman primates and even more important for non-terrestrial species such as orangutans, because nonhuman primates in the wild typically spend the majority of their time in a non-terrestrial setting (Ross et al., 2011). Because Bornean orangutans are the largest non-terrestrial species of primate, assessing the non-terrestrial space utilization is key in optimizing animal welfare (Ancrenaz et al., 2015). Several studies have shown that orangutans typically favor higher spaces. For example, Hebert & Bard (2000), showed that three adolescent orangutans within a zoological setting preferred the upper canopy within their habitat space. However, studies have shown that non-terrestrial foraging can be dependent upon the individual animal. For example, Ashbury et al. (2015) found a difference between foraging habitats of wild females and with adolescent offspring and other age-sex classes of orangutans. There have been studies, however, that have shown wild orangutans do utilize ground locomotion. According to Loken et al. (2013), orangutans of all age-sex classes utilize ground locomotion in areas where deforestation was observed. In addition, various studies, such as Schaik et al. (2008), showed that wild female orangutans tend to spend more time moving and foraging than did male orangutans. There are also studies that show the differences between orangutans' sex-age groupings and their time spent at rest versus moving. For example, Schaik et al. (2008), showed a significant difference between wild male and female orangutans resting and moving times: female orangutans were observed moving more than their male counterparts and male orangutans were observed resting more than females. As Zoo Atlanta strives to provide the animals within their habitats the ability to mimic wild orangutan characteristics, such as non-terrestrial space utilization, it is imperative that staff members promote behaviors that mimic the spatial use of wild orangutans as much as possible.

The study presented here was conducted to establish a baseline data set of spatial use by three Bornean orangutans in their habitat. This baseline is intended to inform subsequent evaluations of the impact of enrichment items, and to assess anecdotal observations of terrestrial behaviors in a species typically considered to be highly arboreal.

METHODS

Each 30-minute session consisted of 1-minute observation intervals by a single observer; observations were recorded at the end of each minute. Data were collected at various times between 0900–0330 hr. The data were collected using Zoo Monitor software (Ross et al., 2016). The Bornean orangutan group was comprised of one adult male, one juvenile male, and one adult female. See Table 1 for specifics regarding the orangutans within the study.

Name	Sex	Date of Birth
Satu	Adult Male	30 November 2003
Miri	Adult Female	9 February 1992
Pelari	Juvenile Male	14 September 2013

Table 1. Study subjects comprising the focal group of Bornean orangutans at Zoo Atlanta.

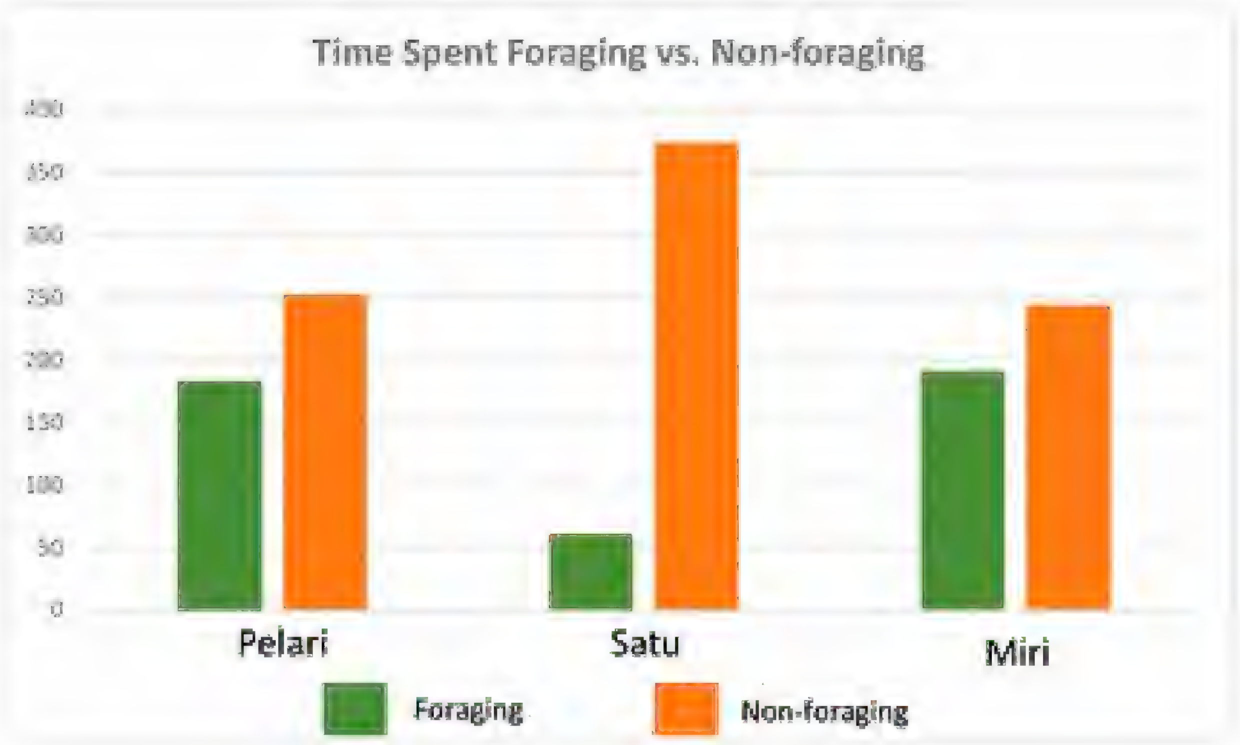

Figure 2. Time the individual orangutans spent foraging vs. any other behavior. The three individuals spent differing amounts of time displaying foraging vs. non-foraging behaviors (see text). Satu spends the least amount of time foraging, while Pelari and Miri spend more, and were both significantly similar regarding the amounts of time foraging.

Behavior	**Description**
Arboreal	Any position that the Bornean orangutans were off the ground, or non-terrestrial
Ground	Any position that the Bornean orangutans were on the ground, or in a terrestrial position
Foraging	Any instance that an orangutan was actively consuming food and/or scavenging for food whether it was in an arboreal or ground position
Other	Any instance that was an orangutan partaking in any behavior besides a behavior that fit the requirements for their "Foraging" behaviors.

Table 2: Behavior Ethogram

Within this paper the term "Arboreal" is defined as any space within a habitat that is non-terrestrial or in any position that is not considered to be consistent with the definition of "Ground" (Table 2). Any Out of View instances recorded were included with the Ground-use behavior, because all Arboreal sites were visible to the researcher.

The habitat (Fig. 1) includes three wooden platforms, two rock fixtures and ropes that connect each area to one another. The two rock structures are pillars made of cement. Both platforms 1 and 2 have hammocks made of woven firehose.

The questions investigated in this study are as follows:

1. Do Pelari, Satu, and Miri spend differing amounts of time foraging?
2. Do the orangutans spend more time on the ground or in an arboreal position?
3. Do the three orangutans use the arboreal features of the habitat differentially?
4. Do the three orangutans use the arboreal objects with different frequencies?

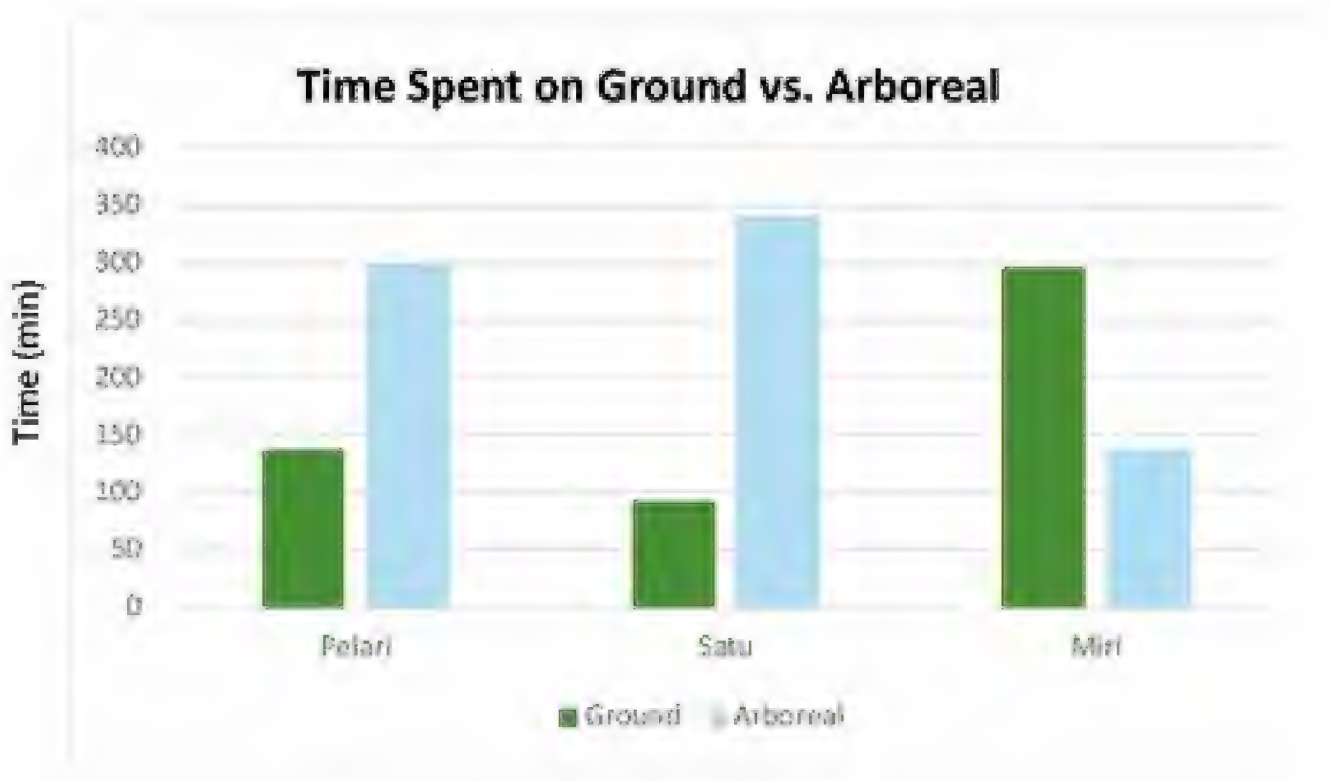

Figure 3. Time spent by individual orangutans on ground vs. in elevated ("arboreal") situations. The three individuals partitioned their time differently with respect to elevated arboreal positions and use of the ground (see text). Miri clearly spent significantly more amount of time on the ground than did the other two orangutans, with Pelari and Satu spending significantly more, and comparable time, arboreally than Miri.

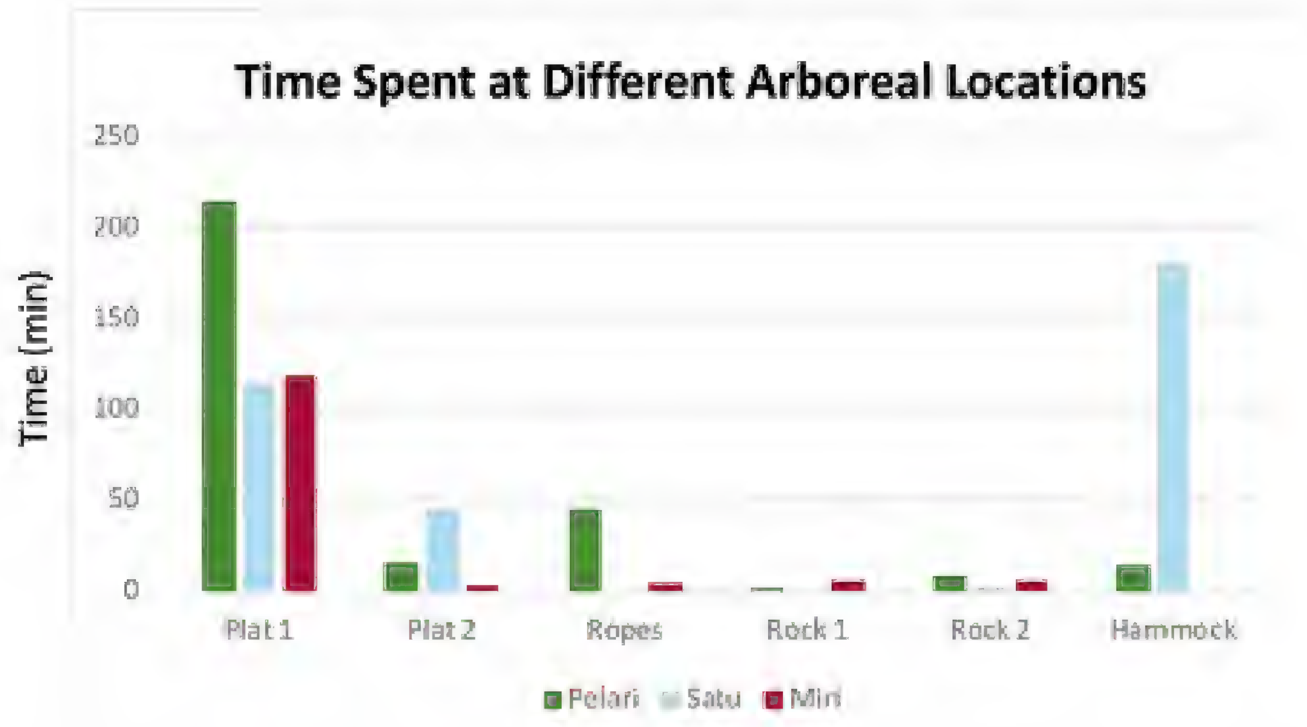

Figure 4. Differential use of arboreal locations by the three focal orangutans. The three individuals used the arboreal features in different frequencies (see text). Pelari used Platform 1 significantly more than any other area of habitat 1, with some use of Platform 2, ropes, and hammock. Satu spent a statistically significant amount of time in the hammock, with a statistically considerable time on Platform 2, and virtually no other arboreal site. Miri spent a statistically significant amount of time on Platform 1, never used the hammock, and showed only small amounts of time on other sites. The test indicates differences in usage among the three orangutans; we did not conduct post-hoc tests to find finer-level differences in these data.

In all cases, the null hypothesis is that the individuals exhibit all behaviors and use all spaces with equivalent frequencies. The data were analyzed using chi-square and chi-square goodness-of-fit tests (https://www.socscistatistics.com/tests/chisquare2/default2.aspx and https://www.socscistatistics.com/tests/goodnessoffit/default2.aspx), with alpha designated as $p < 0.05$.

RESULTS

Question 1: Do Pelari, Satu, and Miri spend differing amounts of time foraging? Yes, the three individuals spent differing amounts of time displaying foraging vs. non-foraging behaviors ($X^2 = 109.8207$, df = 2, 1, $p < 0.00001$; Fig. 2). Satu spent the least amount of time foraging, while Pelari and Miri spent more, and were both significantly similar regarding the amounts of time foraging.

Question 2: Do the animals spend more time on the ground, or in arboreal situations? The three individuals partitioned their time differently with respect to elevated arboreal positions and use of the ground ($X^2 = 220.1025$, df = 2, 1, $p < 0.00001$; Fig. 3). Miri clearly spent significantly more amount of time on the ground than did the other two orangutans, with Pelari and Satu spending significantly more, and comparable time, arboreally than Miri.

Question 3: Do the three animals use the arboreal features of the habitat with different frequencies? Yes, the arboreal features are used differentially, with heavy use of Platform 1 by all animals, heavy use of the hammock, lesser use of Platform 2 and ropes, and very little use of either rock feature ($X^2 = 138.391$, df = 2, 4, $p < 0.00001$; Fig. 4). For this chi-square Goodness of Fit test, the two rock features were combined because of very low usage of those structures by the animals. The test indicates differences in usage among the three orangutans; we did not conduct post-hoc tests to find finer-level differences in these data.

Question 4: Do the three orangutans use the arboreal objects with different frequencies? Yes, Pelari, Satu, and Miri used the arboreal features in different frequencies ($X^2 = 340.1094$, df = 2, 4, $p < 0.00001$; Fig. 4). Pelari used Platform 1 significantly more than any other area of habitat 1, with some use of Platform 2, ropes, and hammock. Satu spent a statistically significant amount of time in the hammock, with a statistically considerable time on Platform 2, and virtually no other arboreal site. Miri spent a statistically significant amount of time on Platform 1, never used the hammock, and small amounts of time on other sites. Note that "hammock" score for Miri and "ropes" for Satu were inflated to a minimal value = 1, because the test will not tolerate values of zero. The test indicates differences in usage among the three orangutans; we did not conduct post-hoc tests to find finer-level differences in these data.

The three individuals spent differing amounts of time displaying foraging behaviors. Satu spent the least amount of time (14%) foraging, compared to 42% min and 44% min for Pelari and Miri, respectively. Overall, the orangutans spent much more time in non-foraging behaviors (66.67 % time) than time spent foraging (33.33% time).

DISCUSSION

In this study, the three Bornean orangutans collectively spent the majority of their time in an arboreal position (58.9 % time) versus on the ground (41.1% time). But, individual patterns of behaviors were variable, most notably in the case of the adult female Miri, who spent only 29% of time in arboreal positions (where she was often joined by her juvenile offspring, Pelari) and 87% of time on the ground (where she was less often joined by offspring Pelari). In contrast, Satu spent 78.1% of his time in an arboreal position and Pelari spent 66.3% of the observed time in an arboreal position. Understanding orangutans' non-terrestrial habitat space usage is important because wild orangutans tend to live exclusively in the non-terrestrial spaces and Zoo Atlanta's goal is to increase non-terrestrial utilization to replicate a wild setting for the orangutans at Zoo Atlanta (Thrope & Crompton, 2005). However, some research suggests that orangutans do utilize the ground for locomotion, thus, it makes sense that orangutans within a zoological setting would also utilize ground locomotion (Ancrenaz et al., 2015). Ashbury et al. (2015) showed that wild flanged males travel via the ground the most out of all age-sex classifications and the other age-sex classification utilized ground locomotion primarily for foraging. Satu rarely left the hammock during observations. When he was moving, the majority of his time was spent moving from arboreal space to arboreal space. Furthermore, the majority of Miri's time spent foraging for food was spent on the ground, which is consistent with the results of Ashbury et al. (2015). The data (Figs. 2–4) indicate differential usage of space and structures among the three orangutans. Satu spent 41% of his time in the hammock, which is suspended from Platform 1. Miri spent much of her time on platform 2 in the woven firehose hammock. Miri spent the most time on the ground, and foraging. Pelari spent much of his time on Platform 1, and generally was found closely associated with his mother Miri; but, note that he spent far more time in arboreal situations, and less time joining her on the ground. Thus, Satu is the most arboreal animal within the Bornean orangutan group in habitat 1 and Miri is the most ground dwelling animal within the Bornean orangutan group. Pelari spends relatively equivalent amounts of time in arboreal vs. ground positions.

As with arboreal vs. ground activity, the amount of time the group spent exhibiting foraging behaviors versus any other behavior also is underscored by variation among the individuals. Satu only foraged about 14% of his observed time, whereas Miri and Pelari showed similar foraging behaviors and spent between 42–44% of their observed time foraging. Some wild orangutan studies have shown that flanged males tend to travel the least amount and rested the most out of all age-sex classes of orangutans (Morrogh Bernard et al., 2008). Thus, Satu only foraging 14% of the time is to be expected.

Understanding orangutans' non-terrestrial habitat space usage is important because wild orangutans tend to live exclusively in the non-terrestrial spaces and Zoo Atlanta's goal is to increase non-terrestrial utilization to replicate a wild setting for the orangutans...

There could be other factors, such as food placement, that plays a key role in the results. Where food was placed

by keeper staff, and if most of the food was on arboreal positions, or if the food were placed or fell onto the ground, could affect the results. Future research studying such influences as weather, environmental stimuli, auditory stimuli and enrichment devices could help understand these data.

CONCLUSION

In regard to providing optimal animal welfare, it is imperative to understand habitat space utilization amongst animals in a zoological setting (Ross et al., 2011). It is imperative to understand the natural behavior of wild animals and provide animals within a zoological setting similar environments to their wild counterparts, thus, understanding non-terrestrial and terrestrial environmental utilization is key in providing animals, such as orangutans, with optimal animal welfare (Ancrenaz et al., 2015). Few studies have shown that wild female orangutans tend to exhibit more foraging behaviors than any other age-sex groupings (Ashbury et al., 2015). This holds true with Miri, as she spent much of her time foraging and Satu spent significantly less time foraging (Fig. 2). Furthermore, the results are consistent with Ashbury et al. (2015) in regard to wild flanged males exhibiting significantly fewer foraging behaviors than females. Furthermore, non-terrestrial space utilization has shown to be a preference for orangutans within a zoological setting that is considered to be consistent with their wild counterparts. According to Hebert & Bard (2000), three adolescent orangutans within a zoological setting preferred the upper canopy within their habitat space, but the cohort observed at Zoo Atlanta exhibits differing preferences. According to Fig. 3, both Pelari and Satu spent the majority of their time in a non-terrestrial position and agrees with the results of Hebert & Bard (2000) regarding non-terrestrial versus terrestrial preferences. However, Miri appears to be an outlier as she tends to prefer terrestrial positions rather than non-terrestrial positions. At Zoo Atlanta, the majority of the orangutans utilize various fixtures within the habitat at various frequencies. According to Fig.4, Platform 1 is significantly utilized more for non-terrestrial space utilization than any other portion of the habitat; each orangutan utilized this space frequently. However, Satu significantly utilized the hammock fixture within the habitat which caused the hammock to be the second most utilized feature within the habitat. Furthermore, according to Fig. 4, the orangutans, on an individual level, utilized different arboreal objects within the habitat at differing frequencies. As mentioned above, Satu significantly utilized the hammock more so than any other member. Thus, causing Miri and Pelari to utilize the hammock space seldomly. Furthermore, according to Fig. 4, Pelari utilized Platform 1 more than any other member as well and Miri utilized ground portions of the habitat more so than any other member. Thus, understanding current spatial use and activity budgets allows animal care staff members a base line to compare future habitat structures and/or objects intended to increase non-terrestrial space utilization.

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ABCs of SSPs

A Guide to AZA's Acronyms UPDATED

By Rebecca Greenberg, AZA Director of Animal Programs

As an **American Association of Zoo Keepers, Inc. (AAZK)** member who subscribes to **Animal Keepers' Forum (AKF)**, you are already most keenly aware that the zoo and aquarium community is rife with acronyms. I could write this entire article in almost all acronyms relating to population management, but let's start with the basics.

The **Association of Zoos and Aquariums (AZA)** is a nonprofit organization committed to being a global leader in promoting species conservation and animal welfare by leveraging the size, scope, expertise, and public trust of its member facilities. AZA helps its members and the animals in their care thrive by providing services advancing animal welfare, public engagement and the conservation of wildlife.

One of the most fundamental aspects of AZA is the cooperative management of animals among AZA-accredited facilities, which is vital for assuring genetically diverse, demographically varied, and biologically sound populations. **Taxon Advisory Groups (TAGs)** examine the management needs of entire taxa, or groups of related species, based upon the needs of the species and AZA-accredited facilities. TAGs establish priorities for cooperative animal management and scientific initiatives, and provide a forum for discussing husbandry, veterinary, ethical, and other issues that apply to entire taxa. TAGs develop **Regional Collection Plans (RCPs)** to recommend species for cooperative management among AZA members, determine the sustainability goals for each recommended **Animal Program (AP)** within its purview, identify objectives relevant to their long-term collection plans, and assure adherence to AZA's animal management goals.

There are 43 TAGs, and managed within the TAGs are nearly 500 **Species Survival Plan® (SSP)** Programs. The mission of an SSP Program is to cooperatively manage an *ex situ* species population with the interest and cooperation of AZA-accredited zoos and aquariums, **Certified Related Facilities (CRFs)**, and approved Sustainability Partners. Each SSP manages the breeding of a species to maintain a healthy and sustainable population that is genetically diverse, demographically stable, and biologically sound. The SSPs develop **Breeding and Transfer Plans (BTPs)** that summarize the current demographic and genetic status of that specific population and recommends breeding pairs and transfers.

Each AZA-accredited facility has one **Institutional Liaison (IL)** assigned, and that individual assures that there are effective communication and participation between the facility and AZA's Animal Programs. The IL designates **Institutional Representatives (IRs)** for each TAG and SSP that their facility participates in. The IR is the primary contact between their facility and the **Program Leaders (PLs)** of the TAG or SSP to which they have been designated, and must review all necessary draft RCPs and BTPs. Program Leaders include TAG Chairs, SSP Coordinators, and Studbook Keepers.

The AZA supports two scientific management centers that focus on enhancing SSP population sustainability: the AZA **Population Management Center (PMC)** hosted by the Lincoln Park Zoo in Chicago, Illinois, and the AZA **Reproductive Management Center (RMC)**, hosted by the Saint Louis Zoo in Saint Louis, Missouri.

The PMC is responsible for conducting demographic and genetic analyses needed to develop and distribute population management recommendations for all SSP Programs. PMC staff, including population biologists and studbook analysts, assist

each SSP Program in the development of their BTPs by making sure the data are accurate, determining the current population status, predicting the future population status, identifying specific breeding recommendations, and distributing the plan to all participating facilities.

The RMC works with the PMC, AZA **Scientific Advisory Groups (SAGs)**, and relevant AZA Committees to advise the AZA community on the efficacy, safety, and reversibility of contraceptive products. Just as safe prevention of reproduction is crucial for non-recommended breeding pairs, successful and healthy reproduction in recommended pairs is critical to population management. The RMC aims to identify causes of female infertility or pair incompatibility with the goal of improving reproductive success in affected individuals.

As mentioned above, SAGs are made up of experts in a particular field of wildlife science including veterinarians, researchers and zoo- and aquarium-based curators with appropriate scientific training, as well as university, government and other external scientists with a commitment to sharing their particular expertise. One SAG that is crucial to AZA's Animal Programs is the **Small Population Management Advisory Group (SPMAG)**, which provides technical advice about population management. SPMAG helps advance the science of applied small population biology and develops tools for use by small population managers. Another important SAG is the **Molecular Data for Population Management Advisory Group (MDPMAG)**, which offers current best practices for collecting and analyzing molecular data and maintaining guidelines for integrating these data into the management of AZA's Animal Programs.

The AZA Board-level committee that oversees all of these moving parts regarding cooperative animal management is the **Animal Population Management (APM) Committee**. The APM Committee works collaboratively with other AZA Committees to promote and evaluate the population sustainability initiatives of AZA.

All of these individuals and groups are working collaboratively to assure genetically diverse, demographically stable, and biologically sound animal populations for generations to come. The goal is not to reinvent the wheel, but maybe to rewrite the alphabet.

END (not an acronym, just stating the obvious)

QUICK REFERENCE

AAZK	AMERICAN ASSOCIATION OF ZOO KEEPERS, INC.
AKF	ANIMAL KEEPERS' FORUM
AZA	ASSOCIATION OF ZOOS AND AQUARIUMS
TAGS	TAXON ADVISORY GROUPS
RCPS	REGIONAL COLLECTION PLANS
AP	ANIMAL PROGRAM
SSP	SPECIES SURVIVAL PLAN®
CRFS	CERTIFIED RELATED FACILITIES
BTPS	BREEDING AND TRANSFER PLANS
IL	INSTITUTIONAL LIAISON
IRS	INSTITUTIONAL REPRESENTATIVES
PLS	PROGRAM LEADERS
PMC	POPULATION MANAGEMENT CENTER
RMC	REPRODUCTIVE MANAGEMENT CENTER
SAGS	SCIENTIFIC ADVISORY GROUPS
SPMAG	SMALL POPULATION MANAGEMENT ADVISORY GROUP
MDPMAG	MOLECULAR DATA FOR POPULATION MANAGEMENT ADVISORY GROUP
APM	ANIMAL POPULATION MANAGEMENT COMMITTEE

ASSOCIATION OF ZOOS & AQUARIUMS

Reimagining Population Management in AZA

The AZA Species Survival Plan® (SSP) Program has become a symbol of AZA's collective commitment to the species that we hold. Over the past few decades, despite our best intentions, we have built a system in which we are trying to manage too many species given our limited resources, and are likely not managing some of them as effectively as we could. Our ability to successfully maintain sustainable populations depends on us all cooperating together. ***Many AZA Animal Program populations are not sustainable, and those animals will no longer exist in zoos and aquariums if we don't change our approach.***

To combat this very real crisis, the AZA Board of Directors directed the Animal Population Management (APM) Committee to develop a new framework for managing Animal Programs, using three guiding principles:

1. **ANIMALS ARE DERIVED FROM BIOLOGICALLY SOUND POPULATIONS.**
2. **ZOOS AND AQUARIUMS DRIVE SSP SPECIES SELECTION.** SSPs will be driven by facility interest and commitment rather than what TAGs want to manage.
3. **ACCOUNTABILITY BY BOTH THE MEMBER FACILITIES AND THE ANIMAL PROGRAM WILL BE BUILT INTO THE FRAMEWORK.**

It is important to note that this "reimagining" of the population management framework is still under discussion, however the current **draft** includes seven objective program and management criteria to be an SSP:

- Majority (>50%) of animals in the managed population are housed in AZA member facilities *(if it's an AZA Animal Program, most of the animals should be in AZA facilities)*
- At least 15 AZA facilities house the species *(there should be some minimum number of AZA facilities housing the species)*
- Program leadership is based within AZA *(if it's an AZA Animal Program, the Program Leaders should be based in AZA)*
- No non-AZA entities significantly impact how animals are managed *(non-AZA entities should not be able to have significant impacts on an AZA Animal Program)*
- The species is not part of a government-led recovery program *(external entities should not make significant breeding or management decisions on AZA Animal Programs)*
- Breeding is not prohibited by government regulations *(if it's an AZA Animal Program, breeding decisions should be determined within AZA, not by external authorities)*
- More animals are acquired through breeding than from non-AZA sources *(an AZA Animal Program shouldn't be dependent on acquiring animals from outside of AZA)*

Once approved and implemented, it's the intention that these new criteria will be used by all TAGs to assess their programs during the Regional Collection Planning (RCP) process, which will make species selection more standardized. The APM Committee does recognize that one size will not fit all, so exceptions may be made in certain cases.

The Committee has also proposed three types of SSP Programs:

1. **SECURE SSPs:** these are species that will still be present in zoos and aquariums in 100 years in a robust, viable, healthy, biologically-sound population.
2. **SIGNATURE SSPs:** these species meet the seven criteria and are on track for long-term sustainability.
3. **PROVISIONAL SSPs:** these species do not currently meet the seven criteria, but they have the potential to do so within a reasonable timeframe.

Programs that do not meet the seven criteria nor fit into one of the three proposed SSP categories **can continue to be managed and supported by holding facilities**. A consortium model, in which one or a few facilities act as a breeding hub(s) for a species, is a potential way to collaboratively manage a population outside the SSP Program. This type of management strategy has already been successful for some species and it allows for facilities to work with species that might not fit well in the SSP model. Although they will not be branded as SSPs, these programs will have more flexibility in how they can be managed.

A group of APM Committee members, Wildlife Conservation Committee members, and AZA government affairs staff is currently considering how best to support government-owned or -managed programs, many of which have a recovery and/or reintroduction component and might not fit into this draft SSP framework. More to come on this in the future.

During the last few months, the APM Committee hosted personalized calls with the leaders of each of the 43 TAGs to talk through how their specific programs might be impacted. The APM Committee is using feedback from these calls to steer ongoing discussions of the framework.

We are still 12-18 months away from implementation of these proposed changes, pending approval by the AZA Board of Directors, and much more work remains. We need all of the AZA community to remain engaged and involved. The APM Committee requests and welcomes your full participation! Please don't hesitate to reach out to Joe Barkowski, APM Committee Chair (jcbski@aol.com), Hollie Colahan, APM Committee Vice Chair (hcolahan@birminghamzoo.com), or the AZA Conservation, Management, and Welfare Sciences staff (animalprograms@aza.org).

Please be a part of helping to find the best solution – we'll be successful if we work together, communicate, and stay open to new approaches!

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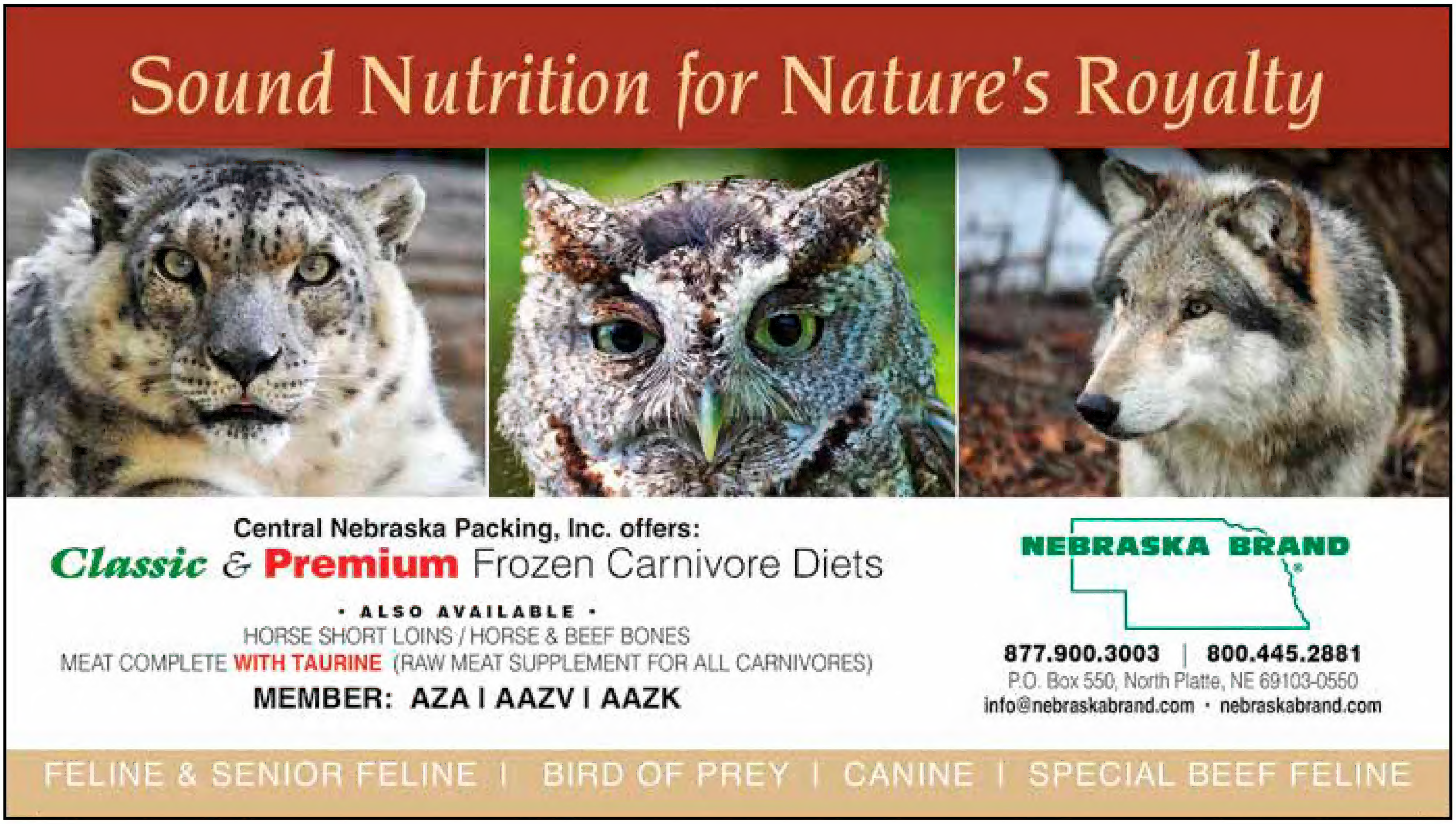

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